Neuroscience, BS

Banner Code: SC-BS-NEUR

Academic Advising

204 Krasnow Institute
Fairfax Campus
Phone: 703-993-4334
Email: neurosci@gmu.edu
Website: neuroscience.gmu.edu

The Bachelor of Science in Neuroscience is an interdisciplinary program emphasizing the relationship between the biology and chemistry of the nervous system and the behavior of an organism. The BS prepares students for graduate-level study in both medical school and doctoral and master’s-level programs in neuroscience and other health-related fields, and work in the neuroscience field.

Admissions & Policies

Admissions

University-wide admissions policies can be found in the Undergraduate Admissions Policies (http://catalog.gmu.edu/admissions/undergraduate-policies/) section of this catalog.

To apply for this program, please complete the George Mason University Admissions Application (https://www2.gmu.edu/admissions-aid/apply-now/).

Policies

Students must fulfill all Requirements for Bachelor’s Degrees (http://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-3-2), including the Mason Core (http://catalog.gmu.edu/mason-core/).

NEUR 410 Current Topics in Neuroscience or NEUR 411 Seminar in Neuroscience fulfill the writing intensive requirement.

For policies governing all undergraduate programs, see AP.5 Undergraduate Policies (http://catalog.gmu.edu/policies/academic/undergraduate-policies/).

Requirements

Degree Requirements

Total credits: minimum 120

Students should refer to the Admissions & Policies tab for specific policies related to this program.

Foundation Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 213</td>
<td>Cell Structure and Function (Mason Core)</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 322</td>
<td>Developmental Biology</td>
<td></td>
</tr>
<tr>
<td>BIOL 326</td>
<td>Animal Physiology</td>
<td></td>
</tr>
<tr>
<td>BIOL 425</td>
<td>Human Physiology</td>
<td></td>
</tr>
<tr>
<td>BIOL 430</td>
<td>Advanced Human Anatomy and Physiology I</td>
<td></td>
</tr>
<tr>
<td>CHEM 211 &amp; CHEM 213</td>
<td>General Chemistry I (Mason Core)</td>
<td>4</td>
</tr>
<tr>
<td>&amp; General Chemistry Laboratory I (Mason Core)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 212 &amp; CHEM 214</td>
<td>General Chemistry II (Mason Core)</td>
<td>4</td>
</tr>
<tr>
<td>&amp; General Chemistry Laboratory II (Mason Core)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 113</td>
<td>Analytic Geometry and Calculus I (Mason Core)</td>
<td></td>
</tr>
<tr>
<td>&amp; MATH 123</td>
<td>Calculus with Algebra/Trigonometry, Part A</td>
<td></td>
</tr>
<tr>
<td>&amp; MATH 124</td>
<td>and Calculus with Algebra/Trigonometry, Part B (Mason Core)</td>
<td></td>
</tr>
<tr>
<td>STAT 250</td>
<td>Introductory Statistics I (Mason Core)</td>
<td></td>
</tr>
<tr>
<td>PSYC 300</td>
<td>Statistics in Psychology</td>
<td></td>
</tr>
<tr>
<td>MATH 352</td>
<td>Statistics</td>
<td></td>
</tr>
<tr>
<td>PHYS 243 &amp; PHYS 244 &amp; PHYS 245 &amp; PHYS 246</td>
<td>College Physics I (Mason Core)</td>
<td>8</td>
</tr>
<tr>
<td>&amp; College Physics I Lab (Mason Core)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp; College Physics II (Mason Core)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp; College Physics II Lab (Mason Core)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS 160 &amp; PHYS 161 &amp; PHYS 260 &amp; PHYS 261</td>
<td>University Physics I (Mason Core)</td>
<td></td>
</tr>
<tr>
<td>&amp; University Physics I Laboratory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp; University Physics II (Mason Core)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&amp; University Physics II Laboratory (Mason Core)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Psychology

1,3
PSYC 100  Basic Concepts in Psychology (Mason Core) (http://catalog.gmu.edu/mason-core/)  3
PSYC 375  Brain and Sensory Processes  3
PSYC 376  Brain and Behavior  3

**Computer Science**

CDS 130  Computing for Scientists  3

**Core Courses in Neuroscience**

NEUR 327  Cellular, Neurophysiological, and Pharmacological Neuroscience  3
NEUR 335  Molecular, Developmental, and Systems Neuroscience  3

**Technical Writing**

NEUR 410  Current Topics in Neuroscience or NEUR 411  Seminar in Neuroscience  3

**Required Psychology Lab Course**

PSYC 373  Biopsychology Laboratory  2

Total Credits  54-57

1 Students must earn a minimum grade of 1.67 (C-) in these courses.
2 The course chosen to fulfill this requirement cannot be applied to the 24 credits of approved neuroscience electives.
3 Transfer students who have earned transfer credit for PSYC 372 Biopsychology may substitute this course for PSYC 375 Brain and Sensory Processes.
4 Either course fulfills the writing intensive requirement.

**Electives**

Students should consult with an advisor to choose appropriate elective courses, which must be approved by the director of the program. A sample of possible electives is given below. Only courses not already taken in the degree will apply as electives, with the exception of seminar and topics courses; a different topic must be addressed in the second instance of a seminar or topics course. Students may apply no more than 6 credits of courses with a grade of ‘D’ to this requirement.

Students intending to pursue a doctorate in neuroscience or a medical degree are advised to take CHEM 313 Organic Chemistry I and CHEM 315 Organic Chemistry Lab I.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BENG 101</td>
<td>Introduction to Bioengineering</td>
<td></td>
</tr>
<tr>
<td>BENG 313</td>
<td>Physiology for Engineers</td>
<td></td>
</tr>
<tr>
<td>BENG 434</td>
<td>Computational Modelling of Neurons and Networks</td>
<td></td>
</tr>
<tr>
<td>BIOL 305</td>
<td>Biology of Microorganisms</td>
<td></td>
</tr>
<tr>
<td>BIOL 306</td>
<td>Biology of Microorganisms Laboratory</td>
<td></td>
</tr>
<tr>
<td>BIOL 311</td>
<td>General Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOL 322</td>
<td>Developmental Biology</td>
<td></td>
</tr>
<tr>
<td>BIOL 323</td>
<td>Lab for Developmental Biology</td>
<td></td>
</tr>
<tr>
<td>BIOL 326</td>
<td>Animal Physiology</td>
<td></td>
</tr>
<tr>
<td>BIOL 417</td>
<td>Selected Topics in Molecular and Cellular Biology (when topic is Foundations of the Mammalian Brain)</td>
<td></td>
</tr>
<tr>
<td>BIOL 420</td>
<td>Vaccines</td>
<td></td>
</tr>
<tr>
<td>BIOL 425</td>
<td>Human Physiology</td>
<td></td>
</tr>
<tr>
<td>BIOL 426</td>
<td>Mechanisms of Aging</td>
<td></td>
</tr>
<tr>
<td>BIOL 430</td>
<td>Advanced Human Anatomy and Physiology I</td>
<td></td>
</tr>
<tr>
<td>BIOL 431</td>
<td>Advanced Human Anatomy and Physiology II</td>
<td></td>
</tr>
<tr>
<td>BIOL 432</td>
<td>Clinical Applications in Human Physiology</td>
<td></td>
</tr>
<tr>
<td>BIOL 452</td>
<td>Immunology</td>
<td></td>
</tr>
<tr>
<td>BIOL 453</td>
<td>Immunology Laboratory</td>
<td></td>
</tr>
<tr>
<td>BIOL 471</td>
<td>Evolution</td>
<td></td>
</tr>
<tr>
<td>BIOL 482</td>
<td>Introduction to Molecular Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOL 483</td>
<td>General Biochemistry</td>
<td></td>
</tr>
<tr>
<td>BIOL 484</td>
<td>Cell Signaling and Disease</td>
<td></td>
</tr>
<tr>
<td>BIOL 515</td>
<td>Developmental Neurobiology</td>
<td></td>
</tr>
<tr>
<td>CHEM 313</td>
<td>Organic Chemistry I</td>
<td></td>
</tr>
<tr>
<td>CHEM 314</td>
<td>Organic Chemistry II</td>
<td></td>
</tr>
<tr>
<td>CHEM 315</td>
<td>Organic Chemistry Lab I</td>
<td></td>
</tr>
<tr>
<td>CHEM 318</td>
<td>Organic Chemistry Lab II</td>
<td></td>
</tr>
<tr>
<td>CHEM 321</td>
<td>Quantitative Chemical Analysis</td>
<td></td>
</tr>
<tr>
<td>CHEM 463</td>
<td>General Biochemistry I</td>
<td></td>
</tr>
<tr>
<td>CHEM 464</td>
<td>General Biochemistry II</td>
<td></td>
</tr>
<tr>
<td>CHEM 465</td>
<td>Biochemistry Lab</td>
<td></td>
</tr>
<tr>
<td>MATH 114</td>
<td>Analytic Geometry and Calculus II</td>
<td></td>
</tr>
<tr>
<td>or MATH 116</td>
<td>Analytic Geometry and Calculus II (Honors)</td>
<td></td>
</tr>
<tr>
<td>MATH 203</td>
<td>Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 213</td>
<td>Analytic Geometry and Calculus III</td>
<td></td>
</tr>
<tr>
<td>MATH 214</td>
<td>Elementary Differential Equations</td>
<td></td>
</tr>
<tr>
<td>NEUR 405</td>
<td>RS: Laboratory Methods in Behavioral Neuroscience</td>
<td></td>
</tr>
<tr>
<td>NEUR 406</td>
<td>Zebrafish Neurodevelopment Laboratory</td>
<td></td>
</tr>
<tr>
<td>NEUR 407</td>
<td>Lab Investigations Using Voltage Clamp Electrophysiology</td>
<td></td>
</tr>
<tr>
<td>NEUR 410</td>
<td>Current Topics in Neuroscience (when not used to fulfill the technical writing requirement)</td>
<td></td>
</tr>
<tr>
<td>NEUR 411</td>
<td>Seminar in Neuroscience</td>
<td></td>
</tr>
<tr>
<td>NEUR 422</td>
<td>Glutamatergic Systems</td>
<td></td>
</tr>
<tr>
<td>NEUR 440</td>
<td>Independent Study in Neuroscience</td>
<td></td>
</tr>
<tr>
<td>NEUR 450</td>
<td>Honors Thesis Proposal</td>
<td></td>
</tr>
<tr>
<td>NEUR 451</td>
<td>Honors Thesis</td>
<td></td>
</tr>
<tr>
<td>NEUR 461</td>
<td>Special Topics in Neuroscience</td>
<td></td>
</tr>
<tr>
<td>NEUR 480</td>
<td>Biological Bases of Alzheimer’s Disease</td>
<td></td>
</tr>
<tr>
<td>PHYS 262</td>
<td>University Physics III (Mason Core) (<a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a>)</td>
<td></td>
</tr>
<tr>
<td>PHYS 263</td>
<td>University Physics III Laboratory (Mason Core) (<a href="http://catalog.gmu.edu/mason-core/">http://catalog.gmu.edu/mason-core/</a>)</td>
<td></td>
</tr>
<tr>
<td>PSYC 304</td>
<td>Principles of Learning</td>
<td></td>
</tr>
<tr>
<td>PSYC 309</td>
<td>Sensation, Perception, and Information Processing</td>
<td></td>
</tr>
<tr>
<td>PSYC 317</td>
<td>Cognitive Psychology</td>
<td></td>
</tr>
</tbody>
</table>
Mason Core and Elective Credits

In order to meet a minimum of 120 credits, this degree requires an additional 39-42 credits which may be applied toward any remaining Mason Core (http://catalog.gmu.edu/mason-core/) requirements (outlined below), Requirements for Bachelor's Degrees (http://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-3-2), and elective courses. Students are strongly encouraged to consult with their advisors to ensure that they fulfill all requirements.

### Mason Core

Some Mason Core (http://catalog.gmu.edu/mason-core/) requirements may already be fulfilled by the major requirements listed above. Students are strongly encouraged to consult with their advisors to ensure they fulfill all remaining Mason Core (http://catalog.gmu.edu/mason-core/) requirements.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC 441</td>
<td>Criminal Behavior: Psychological and Neurological Aspects</td>
<td>3</td>
</tr>
<tr>
<td>PSYC 472</td>
<td>Current Topics in Brain and Behavior</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 24

1. Fulfills the writing intensive requirement.

### Exploration Requirements

To graduate with honors, students must earn a minimum GPA of 3.50 in their honors courses, maintain a minimum cumulative GPA of 3.25, and complete an honors thesis.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEUR 410</td>
<td>Current Topics in Neuroscience or NEUR 411 Seminar in Neuroscience</td>
<td>3</td>
</tr>
<tr>
<td>NEUR 450</td>
<td>Honors Thesis Proposal</td>
<td>2-3</td>
</tr>
<tr>
<td>NEUR 451</td>
<td>Honors Thesis</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Total Credits: 8-10

### Honors

**Honors in the Major**

Highly-qualified students may apply to graduate with honors in the major.

**Eligibility**

To be eligible for admission, neuroscience majors must have completed at least 60 credits and have a minimum cumulative GPA of 3.25 and a minimum GPA of 3.25 in neuroscience courses.

**Honors Requirements**

If accepted, students must take a sequence of three courses, which culminates in the successful completion and presentation of an independent honors thesis.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEUR 410</td>
<td>Current Topics in Neuroscience</td>
<td>3</td>
</tr>
<tr>
<td>NEUR 411</td>
<td>Seminar in Neuroscience</td>
<td>3</td>
</tr>
<tr>
<td>NEUR 450</td>
<td>Honors Thesis Proposal</td>
<td>2-3</td>
</tr>
<tr>
<td>NEUR 451</td>
<td>Honors Thesis</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Total Credits: 8-10

To graduate with honors, students must earn a minimum GPA of 3.50 in their honors courses, maintain a minimum cumulative GPA of 3.25, and complete an honors thesis.

### Accelerated Master's

**Neuroscience, BS/Biology, Accelerated MS**

**Overview**

Qualified undergraduates may be admitted into an accelerated master's program and obtain both a Neuroscience, BS and a Biology, MS (https://catalog.gmu.edu/colleges-schools/science/systems-biology/biology-ms/) within an accelerated time frame. Students admitted to this program may take graduate courses after completing 90 undergraduate credits, and up to 6 credits of graduate work may be used in partial satisfaction of the requirements for the undergraduate degree. If students earn at least a 3.00 GPA in these classes, they are granted advanced standing in the master's program and must then complete an additional 24 credits to receive the master's degree. All other master's degree requirements must be met, including a minimum of 18 credits taken for the master's after the bachelor's degree is complete.

**Application Requirements**

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in the Graduate Admission Policies (https://catalog.gmu.edu/admissions/graduate-policies/) section of this catalog. Application information for this accelerated master's program can be found on the School of Systems Biology's website (https://cos.gmu.edu/ssb/).

Successful applicants will have an overall undergraduate GPA of at least 3.10. Three letters of recommendation, including one from a prospective thesis or project advisor, are required. Additionally, they will have completed the following courses with a GPA of 3.00 or higher:
**Accelerated Option Requirements**

At the beginning of the student’s final undergraduate semester, students must submit a bachelor’s/accelerated master’s transition form (available from the Office of the University Registrar (http://registrar.gmu.edu/)) to the College of Science’s Office of Academic and Student Affairs (https://cos.gmu.edu/about/contact-us/). Students must begin their master’s program in the semester immediately following conferral of the bachelor’s degree.

Students must maintain an overall GPA of 3.00 or higher in graduate coursework and should consult with their faculty advisor to coordinate their academic goals.

After completing 120 credits and all requirements for the bachelor’s degree and filing the Graduation Intent Form, students are awarded a bachelor’s degree.

**Additional Requirements**

- Satisfactory performance in undergraduate coursework must be maintained.
- Satisfactory graduate-level performance in each approved graduate course taken while in undergraduate status (receiving a grade of B or better (3.0 or higher) in each course).
- Submission of documents to complete the master’s application before the published deadline, including a goals statement and a resume. GRE scores are not required.
- Completion of undergraduate degree from George Mason University.
- Confirmation of a graduate faculty advisor.

**Bachelor’s Degree (selected), Bioinformatics Management, Accelerated PSM**

**Overview**

This degree option allows highly qualified George Mason University bachelor’s students to earn a Bioinformatics Management, PSM (https://catalog.gmu.edu/colleges-schools/science/systems-biology/bioinformatics-management-professional-science-masters/) degree in less time than if they had first graduated with a BS degree and then applied to the PSM program sequentially.

**Admission and Processing Requirements**

Students in the Biology, BS (https://catalog.gmu.edu/colleges-schools/science/biology/biology-bs/); Chemistry, BS (https://catalog.gmu.edu/colleges-schools/science/chemistry-biochemistry/chemistry-bs/); Computational and Data Sciences, BS (https://catalog.gmu.edu/colleges-schools/science/computational-data-sciences/computational-data-sciences-bs/); Neuroscience, BS (https://catalog.gmu.edu/colleges-schools/science/neuroscience/program/neuroscience-bs/); or Physics, BS (https://catalog.gmu.edu/colleges-schools/science/physics-astronomy/physics-bs/) with an overall GPA of at least 3.00 in their last 60 credits are welcome to apply to the Bioinformatics Management, PSM (http://catalog.gmu.edu/colleges-schools/science/systems-biology/bioinformatics-management-professional-science-masters/) accelerated master’s program. Applicants to this accelerated master’s should have previously taken courses in molecular biology, computer science, calculus, physical chemistry, and statistics. Students with deficiencies in one or more of these areas may be required to take additional courses from the undergraduate curriculum.

The GRE requirement is waived for students accepted into this accelerated program.

By the beginning of the undergraduate student’s senior year, they should submit a Graduate Application for Accelerated Master’s Program form (obtained from the College of Science’s Office of Academic and Student Affairs (https://cos.gmu.edu/about/contact-us/)).

By at least the beginning of their senior year, students should seek out the Bioinformatics Management, PSM (https://catalog.gmu.edu/colleges-schools/science/systems-biology/bioinformatics-management-professional-science-masters/) Program Director who will aid the student in choosing the appropriate graduate courses to take and help to prepare the student for graduate studies.

In their senior year, accelerated master’s students must complete the two graduate courses indicated on their Accelerated Master’s Program Application with a minimum grade of 3.00 in each course. They must maintain a minimum GPA of 3.00 in all coursework and in coursework applied to their major. In the semester specified on the application (around the completion and conferral of the undergraduate degree), students must submit the Bachelor’s/Accelerated Master’s Transition form (found on the Office of the University Registrar website (http://registrar.gmu.edu/forms/)) and will subsequently be admitted into graduate status.

**Reserve Graduate Credits**

Students admitted to this program may take graduate courses after completing 90 undergraduate credits, and up to 6 credits of appropriate graduate coursework may be used in partial satisfaction of the requirements for the undergraduate degree. If students earn at least a 3.00 GPA in these classes, they are granted advanced standing in the master’s program and must then complete an additional 25 credits to receive the master’s degree.

To apply these credits to the master’s degree, students must request that the credits be moved from the undergraduate degree to the graduate degree using the Bachelor’s/Accelerated Master’s Transition form found on the Office of the University Registrar website (http://registrar.gmu.edu/forms/) (as noted above).

Students may take up to 6 additional approved graduate credits as reserve graduate credit. These credits do not apply to the undergraduate degree but will reduce the subsequent master’s degree credits.

---

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 213</td>
<td>Cell Structure and Function (Mason Core)</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 214</td>
<td>Biostatistics for Biology Majors</td>
<td>3-4</td>
</tr>
<tr>
<td>BIOL 214</td>
<td>Introductory Statistics I (Mason Core)</td>
<td></td>
</tr>
<tr>
<td>STAT 250</td>
<td>Statistics in Psychology</td>
<td></td>
</tr>
<tr>
<td>PSYC 300</td>
<td>Statistics in Psychology</td>
<td></td>
</tr>
<tr>
<td>MATH 352</td>
<td>One Course in Statistics:</td>
<td></td>
</tr>
<tr>
<td>BIOL 308</td>
<td>Foundations of Ecology and Evolution</td>
<td>5</td>
</tr>
<tr>
<td>NEUR 327</td>
<td>Cellular, Neurophysiological, and Pharmacological Neuroscience</td>
<td></td>
</tr>
<tr>
<td>NEUR 335</td>
<td>Molecular, Developmental, and Systems Neuroscience</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 311</td>
<td>General Genetics</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 313</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 315</td>
<td>Organic Chemistry Lab I</td>
<td>2</td>
</tr>
</tbody>
</table>

---

**Coursework and Requirements**

- **Reserve Graduate Credits**
  - Students may take up to 6 additional approved graduate credits as reserve graduate credit. These credits do not apply to the undergraduate degree but will reduce the subsequent master’s degree credits.

---

**Additional Requirements**

- Satisfactory performance in undergraduate coursework must be maintained.
- Satisfactory graduate-level performance in each approved graduate course taken while in undergraduate status (receiving a grade of B or better (3.0 or higher) in each course).
- Submission of documents to complete the master’s application before the published deadline, including a goals statement and a resume. GRE scores are not required.
- Completion of undergraduate degree from George Mason University.
- Confirmation of a graduate faculty advisor.
accordingly (e.g., with 6 credits counted towards undergraduate degree plus the maximum 6 reserve credits, the PSM could be completed with 19 post-bachelor’s credits). The ability to take courses for reserve graduate credit is available to all high achieving undergraduates with the permission of the School of Systems Biology (https://catalog.gmu.edu/colleges-schools/science/systems-biology/).

Policies
For more detailed information on accelerated master’s in general, see AP6.7 Bachelor's/Accelerated Master's Degrees (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7).

For policies governing all graduate programs, see AP6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies/).